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October 1, 2020

VIA ELECTRONIC FILING

The Honorable Jocelyn G. Boyd
Chief Clerk/Executive Director
Public Service Commission of South Carolina
101 Executive Center Drive, Suite 100
Columbia, SC 29210

Re: Petition of Duke Energy Carolinas, LLC and Duke Energy Progress, LLC for Approval of CPRE Queue Number Proposal, Limited Waiver of Generator Interconnection Procedures, and Request for Expedited Review
Docket No. 2018-202-E

Dear Ms. Boyd:

Pursuant to the Public Service Commission of South Carolina's ("Commission") Order No. 2019-247 issued on April 9, 2019, in the above-captioned docket, Duke Energy Carolinas, LLC and Duke Energy Progress, LLC (collectively, the "Companies") hereby respectfully provide the Commission an update on the Companies' most recent Distributed Energy Resources ("DER") Technical Standards Review Group ("TSRG") meeting held on September 2, 2020.[1]

The following attachments enclosed with this update provide a more detailed account of the previous TSRG meeting and issues discussed:

- **Attachment A:** September 2, 2020 Meeting Agenda
- **Attachment B:** September 2, 2020 Minutes and Attendance
- **Attachment C:** Inverter Volt-Var Study Scope Review
- **Attachment D:** Update and Discussion-Action Plan to Implement 1547-2018 Presentation
- **Attachment E:** Periodic Self-Inspection Plan Update
- **Attachment F:** Solar Operational Report
- **Attachment G:** Distributed Generation Guidance Map - Presentation

As described in the Companies' June 6, 2019 Report in this docket, the TSRG webpage, https://www.duke-energy.com/business/products/renewables/generate-your-own/tsrg, provides

[1] The TSRG meeting was originally scheduled for July 21, 2020 but was rescheduled due to COVID-19.

meeting materials from each prior TSRG meeting, as well as other technical standards documents. The next TSRG meeting is tentatively scheduled for October 28, 2020.

Sincerely,

Rebecca J. Dulin

Attachments

C: Parties of Record (via email w/ attachments)

Interconnection Technical Standards Review Group (TSRG)
Duke Energy Carolinas/Progress
Meeting Agenda
September 2, 2020

In-person meeting converted to web meeting to follow distancing guidelines for COVID-19

9:00	Safety & Welcome – Wes Davis, Duke
9:05	Second Volt-VAR study scope – Anthony Williams, Duke
9:25	IEEE 1547 implementation plan – Anthony Williams, Duke
10:05	Periodic self-inspection plan update – Kevin Chen, Duke
10:50	Break
11:00	ISOP Update – Ryan Boyle, Duke
11:30	New DER Operational Report – Jonathon Rhyne, Duke
11:45	Additional discussion on topics, if needed
11:55	Wrap up & next meeting date – Wes Davis, Duke (Recommend Oct 27, 28)
12:00	ADJOURN

Duke Energy Carolinas/Progress Interconnection Technical Standards Review Group (TSRG)

Meeting Minutes

September 2, 2020

I. Opening

This is a regular meeting called to order at 9:01 AM via Microsoft Teams

Meeting facilitator: Anthony Williams

Minutes: Jonathon Rhyne

II. Record of Attendance

Member Attendance

Name	Affiliation	Attendance
Kelsy Green	Advanced Energy	Present
Shawn Fitzpatrick	Advanced Energy	Present
Staci Haggis	Advanced Energy	Present
Craig Munger	Cypress Creek Renewables	Present
Luke O'Dea	Cypress Creek Renewables	Present
Todd Rouse	Cypress Creek Renewables	Present
Anthony Williams	Duke Energy	Present
Jonathon DeMay	Duke Energy	Present
Jonathon Rhyne	Duke Energy	Present
Kevin Chen	Duke Energy	Present
Li Huimin	Duke Energy	Present
Orvane Piper	Duke Energy	Present
Ryan Boyle	Duke Energy	Present
Scott Griffith	Duke Energy	Present
Ben Brigmann	Ecoplexus	Present
Chuck Ladd	Ecoplexus	Phone
Chris Sandifer	Embarq	Phone
Dustin Metz	NC Public Staff	Present
Jay Lucas	NC Public Staff	Present
Tommy Williamson	NC Public Staff	Present
Adam Foodman	O2 Emc	Present
Dawn Hipp	ORS SC	absent
Morgan O'Neil	ORS SC	Present
Robert Lawyer	ORS SC	Present
Mike Whitson	PowerOn Energy 3rd Party QA	Present

Name	Affiliation	Attendance
Brad Micallef	Solar Operations Solutions	Present
John Gajda	Stata Solar	Present
Add the absent		absent
Gretchen Pool		Present

III. Current agenda items and discussion

1) The published agenda was emailed.
2) Agenda was modified to allow Anthony Williams to present first, so he could attend to an urgent matter.

3) PRESENTATION: Second Volt-Var Study Scope – Anthony Williams, Duke Energy
   A) Presentation provided with minutes
   B) Q&A:
   Q – Foresee linkage to next stage of complex planning guidelines, DER feeder effectiveness and planning capacity for DER?
   A – At this time volt-var control is only being considered for mitigation of high voltage caused by DER interconnection. The main benefit of this control is to the DER, not the system. However, volt-var can allow more DER to connect.
   Q – How to do a future study? If allow more IRs, where does residential fit in?
   A – 1547 will address residential; this study is only for UDER with a SIS. Not applicable to RDER.
   C) Comments:
   Feedback to NCCEBA, Duke moving in right direction. More members voiced support for the volt-var study effort.
   It was noted that a report by Bryan Lydic (IREC) has been published about the timeline of IEEE-1547 functions coming to market.

4) PRESENTATION: IEEE-1547 Implementation Plan – Anthony Williams, Duke Energy
   A) Presentation Provided with minutes
   B) Q&A:
   Q – 6.4.1 work ongoing with transmission identifying requirements for volt/var tripping? Propose setting at some point? Require settings to new & existing sites?
   A – Work continues to look at the settings and guidance. While the final settings and implementation requirements are not finalized, it is likely that some utility recloser control changes are required and the inverter settings will change; possibly requiring some downtime.
   Q – How long to implement settings, once required? Do all the approved transformer configurations maintain zero sequence continuity?
   A – The implementation schedule will be discussed and coordinated with DER owners once the scope is known. Duke will verify that the approved transformer configurations maintain zero sequence continuity and update the document (see section 4.2).

C)

Comments:

Current UL-SA supports some of the -2018 inverter functions.

A- Yes, but how to use them. If the industry members have a timeline, Duke will review.

5) PRESENTATION: Periodic Self-Inspection Plan Update – Kevin Chen Duke Energy

A) Presentation provided with minutes

B) Q&A:

Q – Training format? Duration?

A – Online, up to developers on duration

Q – Does the self-inspection program apply to both NC & SC?

A – NC & SC, but voluntary.

Q – Ease transition to projects? Promote vendor? Comply with standards as of in-service date?

A – Will NOT promote vendor. Let's focus on major issues that relevant standards did not change in revision, NOT minor issues that might be introduced by code & standards revision.

Q – How will old sites be addressed and will both NEC & NESC be referenced? 2019 NCIP calls out 2002 code. If site built in 2014 will it use 2014 NEC? Which NEC to use? NESC has some use. Calls for Clarification! In-service date and active code at that date?

Q – Are minor violations actually minor? Example: Duke Energy site accessibility issue. Developer thought it just needed to be mowed and maintained, but Duke Crews need to pull up a bucket truck to service.

Q – Building Standards at time you pull permit, which is applicable?

Q – Suggest adding a list of applicable codes and standards (with version, year) in the 5 year report template.

A – Duke doesn't have copies of all old standards. Goal to improve reliability. Inspections to site(s) built prior to 2015, issues need to be addressed. Plan a work in progress. Feedback needed from developers to better address moving forward.

Q – Developers who volunteer and raise issue, will they be penalized? Will developers stay anonymous and all developer info redacted/confidential? Share the findings from the pilot with the TSRG.

A – Duke asks for pilot volunteers. Gray areas will come up, that is why the pilot is crucial. There will be no penalty to the volunteers.

A – Not a program to vilify anyone. Goal to improve/verify interconnection reliability.

Q – NCCEBA has engineers for inspections. Do internal engineers comply?

A – Yes, if qualified to perform work they're acceptable.

C) Comments:

Prefer Online format and quarters 3 & 4 are busiest times.

Piloting beginning of year 2021. To send comments after meeting about NCCEBA fully supports.

Duke would like to have independent inspections at 5 volunteer sites, 2 sites volunteered so far.

6) PRESENTATION: ISOP Update – Ryan Boyle, Duke Energy
   A) Presentation provided with minutes
   B) Q&A:
      Q – Available to developers in GIS parcels/plots and how often updated?
         A – Available in highway & lat/long views. Updated annually.
      Q – Area specific? Does it show where system is constrained? Power factor an input?
         A – Potential to implement additional data sources in the future. (Jonathon Demay) detailed studies consider zone of regulation for LVR. Full power flow study must be run for this analysis so do not think it helpful to include power factor in map.
      Q – Overlay transmission areas?
      A – Possible, but distribution focused. Keep T&D separate.
      Q – Release expected?
      A – Mid October. Email to developer when live.
   C) Comments: Send Comments on map to Anthony Williams to relay to Ryan Boyle.
7) PRESENTATION: New DER Operational Report – Jonathon Rhyne, Duke Energy
   A) Presentation provided with minutes
   B) Q&A:
      Q – Will report be real-time?
         A – Currently weekly, moving to daily refreshing every morning.
      Q – Report include Amps for insight on generation?
         A – Only breaker status included in report.
8) Date for the next meeting and location
   A) Dates for the next meeting were proposed: Oct 27, 28
      i. No objections
   B) The next meeting is expected to be online rather than in person because of COVID
9) The meeting concluded at 12:58 PM

IV. Attachments

1) Agenda, "TSRG Agenda 2020_0902, Rev 1.pdf"
2) Presentations
   A) Second Volt-VAR study scope, "Second Volt-VAR study Scope Review.pdf"
   B) IEEE 1547 implementation plan,
      "TSRG Implement 1547 Update, September 2 2020, Rev 0.pdf"
   C) Periodic self-inspection plan update, "Self-inspection plan_TSRG_09022020.pdf"
   D) New DER Operational Report, "Solar_Operational_Report.pdf"
   E) ISOP Update, "TSRG presentation - DG Guidance map 09-02-2020.pdf"
3) References
   A) None

TSRG: Inverter Volt-VAR Study Scope Review

Anthony C Williams, DER Technical Standards

September 2, 2020

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Logistics

- Clarifying questions will be answered during the presentation; major discussions at the end
- Written feedback and comments will be solicited using comment form
  - Note questions then lets discuss – don't really want all the questions sent in that are mainly just for clarification – this takes a lot of time to address that could be spent on the comments and recommendations
  - It would be helpful to provide more Comment and Proposed Change details :

Stakeholder Name	Page Number	Paragraph Number	Comment	Proposed Change
example Question format	3	2	Why is winter data excluded?	None
example Comment format	7	4	Agree with the hours of study.	None
example Comment format	7	4	'the largest' is not clear	Replace 'the largest' with 'the maximum of the three phase currents"
example Recommendation format	10	3	The types of faults is too limited. Include single line to ground faults.	Include SLG faults

response.

- Comments will be taken during the discussion and the form will be distributed after the meeting
- Share the feedback form using email: Duke-IEEE1547@duke-energy.com for stakeholders to provide their written feedback

Inverter Volt-VAR Study Overview

- North Carolina Commission had tasked Duke to evaluate software-based controls of advanced inverters according to IEEE 1547-2018 standard.
- Evaluate the use of autonomous voltage-reactive power control functions at multiple inverter-based distributed energy resources connected to the same feeder. Understand whether and how these controls cooperate with existing integrated voltage and VAR control systems.
- Evaluate the benefit and effectiveness of distributed voltage-reactive power controls at the distribution feeder level.
- Evaluate mitigation options required at the distribution feeder level to meet transmission imposed requirements for reactive power

First Study Recommended Next Steps

- Conduct time series power flow studies to look at system response over many hours
- Voltage controller concerns
  - With the IVVC commitments, how will those controls manage DER reactive power if something other than a fixed pf is used
  - Consider how to control the feeder head compensation capacitor with autonomous controls
  - Impact on feeders with regulators that use resistive drop compensation; could require significant feeder changes if the drop compensation is removed to accommodate DER reactive power control
  - Use the time series to investigate how well the existing voltage control device controllers manage the DER reactive power
- Consider controls that get more var absorption to hold voltage under 1.05
- Review the impact of higher var absorption on the feeders (closer examination of reactive power flow on the feeder)
- Consider pf based controls for voltage independence and voltage reference to absorb less reactive power at steady state
- Identify potential pilot sites; following further clarification from the additional steps above

Second Study Overview

- Expand the attributes monitored during the study; to inform conclusions
- Calculate P and Q responses
- Quasi-Static Time Series (QSTS) simulation using 8760 hourly load and solar profile
- Consider a broader variety of controller types
  - Limited controller setting variations: approximately 6 volt-var, 8 pf, 5 watt-var
  - Continued use of volt-watt to backup the primary controller
- More emphasis on higher voltage feeders so that less DER forces the overvoltage
- Compare monitored attributes across the feeders for the various controller types
  - Inform policy development to guide application of DER voltage and reactive power controls, and
  - Develop methods to a) provide a quick assessment of reactive power control effectiveness at a potential UDER interconnection point, and b) indicate the most appropriate type of control
- Interim update at October TSRG
- Final report February, presentation at the following TSRG

BUILDING A **SMARTER** ENERGY FUTURE℠

Update and Discussion: Action Plan to Implement 1547-2018 TSRG Meeting

Anthony C Williams, P.E.
Principal Engineer

DER Technical Standards
September 2, 2020

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Agenda

- Review main revisions
  - Current version is “Duke Energy IEEE 1547 Implementation Guidelines, Rev 1”
- Next steps
- Discussion

Ground Rules

- All Stakeholder Group meetings, webinars and information exchange are designed solely to provide an open forum or means for the expression of various points of view in compliance with **antitrust laws**.
- Under no circumstances shall Stakeholder Group activities be used as a means for competing companies to reach any understanding, expressed or implied, which tends to **restrict competition**, or in any way, to impair the ability of participating members to exercise independent business judgment regarding matters affecting competition or regulatory positions.
- Proprietary information shall not be disclosed by any participant during any group meetings. In addition, no information of a secret or **proprietary** nature shall be made available to Stakeholder Group members.
- All proprietary information which may nonetheless be publicly disclosed by any participant during any group meeting shall be deemed to have been disclosed on a **non-confidential** basis, without any restrictions on use by anyone, except that no valid copyright or patent right shall be deemed to have been waived by such disclosure.

Logistics

- Clarifying questions will be answered during the presentation and stakeholder discussions at the end of the presentation
- Written feedback and comments will be solicited using comment form
  - Note questions then lets discuss – don't really want all the questions sent in that are mainly just for clarification – this takes a lot of time to address that could be spent on the comments and recommendations
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example Recommendation format	10	3	The types of faults is too limited. Include single line to ground faults.	Include SLG faults

  - Being more specific makes the point, or main concerns, of the comment more apparent and allows a more direct response.
- Comments will be taken during the discussion and the form will be distributed after the meeting
- Share the feedback form using email: Duke-IEEE1547@duke-energy.com for stakeholders to provide their written feedback

Priority Groups 1 – 5 Review

1st	• Reactive power and voltage control • Power quality
2nd	• Voltage tripping and ride through • Frequency tripping and ride through
3rd	• Most important sections of Section 4, General Tech Specs
4th	• Most commonly applied sections of Section 4, General Tech Specs
5th	• Remaining sections of Section 4, General Tech Specs

Priority Table Updates, Group 1

TSRG Priority Order (Duke ID)	IEEE 1547 Section	IEEE 1547-2018 Topic	Technical Position Summary	Interoperability Summary	Test and Verification Summary
1 (DUK-01)	5.2	Reactive power capability of the DER	Category B 35° C ambient or higher at rated voltage	No Reqmt	Eval + Comm Test
1 (DUK-02)	5.3	Voltage and reactive power control	Study in progress	Yes	Eval + Comm Test
1 (DUK-03)	5.4.2	Voltage-active power control	Study in progress	Yes	Eval + Comm Test
1 (DUK-04)	7.4	Limitation of overvoltage contribution	Accept 1547 with additional requirements~~Pending. Likely requires more industry experience or analysis to address this issue~~	TBD	Eval + Comm Test
1 (DUK-05)	7.2.3	Power Quality, Flicker	Accept 1547 in conjunction with continued use of IEEE 1453~~Continue existing criteria and policy~~	No Reqmt	Eval + Comm Test
1 (DUK-06)	7.2.2	Power Quality, Rapid voltage change (RVC)	Continue existing criteria and policy	TBD	Eval + Comm Test

Priority Table Updates, Group 2

TSRG Priority Order (Duke ID)	IEEE 1547 Section	IEEE 1547-2018 Topic	Technical Position Summary	Interoperability Summary	Test and Verification Summary
2 (DUK-07)	6.4.1	Mandatory voltage tripping requirements (OV/UV)	Have existing setpoints; new 1547 setpoint study in progress ~~TBD~~	TBD	Eval + Comm Test
2 (DUK-08)	6.5.1	Mandatory frequency tripping requirements (OF/UF)	Have existing setpoints; new 1547 setpoint study in progress ~~setpoints TBD~~	TBD	Eval + Comm Test
2 (DUK-09)	6.4.2	Voltage disturbance ride-through requirements	Study in progress	TBD	Eval + Comm Test
2 (DUK-10)	6.5.2	Frequency disturbance ride-through requirements	Study in progress	TBD	Eval + Comm Test
2 (DUK-11)	6.5.2.7	Frequency-droop (frequency-power) capability	~~TBD~~Evaluation has not begun	No Reqmt	Eval + Comm Test
2 (DUK-12)	6.5.2.6	Voltage phase angle changes ride-through	Study in progress~~TBD~~	No Reqmt	Eval + Comm Test
3 (DUK-13)	4.5	Cease to energize performance requirement	Accept 1547 as written	Yes	Eval + Comm Test

Priority Group 1 Revisions

- DUK-05 Section 7.2.3 – Flicker, ready to be implemented

> Duke Energy adopts these requirements as written in the Standard. Note that Duke also applies IEEE 1453 recommended practices.

- DUK-04 Section 7.4 – Limitation of overvoltage contribution, ready to be implemented.

> Duke Energy adopts these requirements as written in the Standard. The industry has found that the inverter designs are reaching and exceeding the harmonic monitoring capabilities of existing measurement devices. Therefore, Duke Energy requires the DER owner to mitigate all order harmonics to no greater than 0.3% if the harmonics affect other customers. Harmonic limits shall be aggregated and applied during the DER hours of operation.

Priority Group 2+ Revisions

- DUK-17 Section 4.2 – Reference points of applicability (RPA)

  The final position must consider the variety of RDER and UDER interconnections and identify the RPA for each. In practice, the interconnections have been very straightforward. The default RPA is the PCC. The RPA for UDER is the PCC (point of common coupling at the utility interconnection point) and the PoC (point of connection) is the RPA for the net meter installations. The approved UDER transformer connections all maintain zero sequence continuity.

- DUK-07 Section 6.4.1 – Mandatory voltage tripping requirements

  Consensus was reached with Transmission System Planning and Operations for POI Recloser voltage and frequency settings and time delays that provide adequate ride-through for BES events. The team is still reviewing the impact to system protection with the proposed settings.

- Several sections have Verification and test requirements updates

Priority Group >5 Updates

- DUK-112 Section 10.3, 10.4 – Nameplate and configuration information

These sections address the two broad types of information available through the local DER communication interface. The following terms are listed in decreasing order of magnitude. The value of each parameter in the list is greater than or equal to the value of the parameter below it: Nameplate Apparent Power Maximum Rating Configuration Apparent Power Maximum Rating Nameplate Active Power Rating (unity power factor) Configuration Active Power Rating (unity power factor)
The list above does not address all the terms in the table. Such a specification is not necessary of every term, but helpful to clarify for some. Duke will consider addressing other terms as needed. Consequently, operational limits and settings, such as the Active Power Limit, cannot be greater than the ratings (not applicable to abnormal or protection settings).

Recommended Next Steps

- Awaiting further information from the ongoing study by Protection and Transmission Planning groups
- Continue with the inverter reactive power control studies
- Maintain focus on the Priority groups 1 and 2
- Additional thoughts?

Discussion

- Stakeholder input on the guidelines
- Sections Completed
  - DUK-05 Section 7.2.3 – Flicker
  - DUK-04 Section 7.4 – Limitation of overvoltage contribution
  - --- Previously ---
  - DUK-01 Section 5.2 – Reactive power capability of the DER

Periodic Inspection Program
Self-inspection Plan – Update

Kevin Chen 9/2/2020

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Agenda

- Self-inspection Process Update
- Expected Timeline
- IEEE Std 1547-2018 Education and Credentialing Program
- Q&A, open discussion

Documents shared in July 2020:

1. Comments resolution tracking sheet
2. Process document redline version in PDF
3. Process document clean version in PDF
4. Instruction manual redline version in PDF
5. Instruction manual clean version in PDF
6. Report template redline version in PDF
7. Report template clean version in WORD
8. Report template (device info and settings) in EXCEL

Additional material under development:

- Full list of issues from pilot periodic inspection in 2018 and 2019
  - It will be served as reference in the technical training.

Self-inspection and Reporting Cycles

- The self-inspection and report on construction quality and site maintenance is required every 5 years for the Generating Facilities with all previously identified construction quality issues addressed and without new construction (5-year cycle). The inspection report must be prepared under the responsible charge of a professional engineer (PE) and must be sealed by the PE.
- The self-inspection and report on interconnection equipment settings is required annually (1-year cycle). Interconnection customer shall use the provided Excel template to report the equipment settings. This report does not require a PE stamp.
- The proof of clear access to Duke Interconnection Facilities is required annually (1-year cycle). Interconnection customer shall provide a photo of the Duke Energy Interconnection Facilities as proof of meeting all requirements. This does not require a PE stamp.

Reporting Cycles Summary

Every 5 years

- Submit a PE stamped inspection report.
  - Follow the self-inspection instruction manual.
  - It is recommended to use the provided report template. Customers can add logo, watermark, color scheme to customize it. Bottom line: use your own report format following the outline provided in the template.
  - Proof of transformer, inverter, other protection devices data is required as part of the inspection report.

Every year

- Submit the transformer, inverter, other protection devices data only using the Duke provided Excel template.
- Submit the photos of Duke's recloser and meter poles.

5-year inspection plan

- The Facilities to be self-inspected will be prioritized based on the number of years in service.
- Prior to the effective date of the self-inspection program, Duke will develop a list of all uninspected facilities sorted by the date of commercial operation.

Project Queue Number	Utility Company	County	Commercial Operation Date	Expected Self-inspection Year	Customer inspection schedule
CHKLIST-000A	DEP		4/16/2012	2021	Q2 2021
CHKLIST-00BA	DEP		6/30/2012	2021	Q3 2021
CHKLIST-02CF	DEC		12/15/2012	2021	Q1 2021
……			……	……	……
CHKLIST-22QM	DEC		4/1/2013	2021	Q4 2021
CHKLIST-MD9A	DEP		6/30/2013	2022	Q4 2021
CHKLIST-ZBP3	DEP		12/20/2013	2022	Q1 2022
……			……	……	……
CHKLIST-77TH	DEP		7/15/2014	2022	Q1 2023
CHKLIST-9J43	DEP		10/12/2014	2023	Q2 2023
……			……	……	……
CHKLIST-F3KY	DEP		5/1/2015	2023	Q4 2023
CHKLIST-BS3W	DEC		12/31/2015	2024	Q3 2024
……			……	……	……
CHKLIST-RP7N	DEP		4/15/2016	2024	Q3 2024

Example of inspection schedule
*This is not real customers information.

40-60 sites each year

Specify month if possible

Flexible schedule is allowed

- The interconnection customers are encouraged to plan ahead and develop an inspection schedule for all their facilities. Duke will collect the inspection schedule from the customers and maintain a list of the upcoming 5-year inspection plan.
- A shortened inspection cycle, immediate full self-inspection or Full-scale Audit Inspection may be triggered by issues (operational, power quality, re-construction, etc.) identified out of the inspection schedule.

Other Comment Resolution

- Applicable codes and standards
  The instruction manual page 3 has been updated to show the list of codes and standards that must be complied with as defined in NCIP. Then the Duke's standards and guide to be applicable as the IA date defines, or at customer's discretion.
- UL listing requirement
  The NCIP only require UL listing for the generator equipment package. The instruction manual has been revised to only require the inverters to be listed.
- Power limit settings
  Would still require checking and logging of the active power limit settings. Supporting material is needed if the power limit settings exceed the maximum physical export capability. The customer shall explain how that complies with the Maximum Physical Export Capability supported by calculation, simulation, or historical data.
- Inspection requirements
  Deleted all "tips" from the instruction manual. Leave only plain language in the manual. Examples of inspection findings will be shared in the technical training.

Agenda

- Self-inspection Process Update
- Expected Timeline
- IEEE Std 1547-2018 Education and Credentialing Program
- Q&A, open discussion

Expected Timeline

- 1/21/2020 – Presented the initial version of self-inspection plan at TSRG meeting
- 4/28/2020 – Presented the self-inspection process update at TSRG meeting
- Q2, 2020 – Collected feedback and refined the self-inspection process
- July, 2020 - Self-inspection documentation updated after 1st round comments
- We will continue to collect comments and feedback from industry on the self-inspection documentation, and other general comments or suggestion on the self-inspection program.
- Early October – Technical training on the topic of self-inspection
- By the end of December – Pilot the program with volunteer customers
  - Take the first 5 volunteers (sites) from developers.
  - If we don't have 5 volunteers, Duke will pick the rest based on feedback from DCC and others.
  - Further refine the self-inspection process with lessons learned from the pilot.
- Full deployment of self-inspection program is expected in 2021.

Agenda

- Self-inspection Process Update
- Expected Timeline
- IEEE Std 1547-2018 Education and Credentialing Program
- Q&A, open discussion

ICAP 1547 Introduction

- Duke Energy has been involved with the ICAP 1547 program since its inception.
- IEEE Standard Association is reaching out to multiple utilities including Duke Energy to initiate the "*DER Interconnection Commissioning Education and Credentialing Program*".
- Some slides from IEEE's presentation to Duke are provided in the following pages for your information.
- Duke would like to hear comments and opinions from TSRG members on this program.
- Duke has signed up as member of the Utility Advisory Board (UAB) of the program.
  - Other utility members of the UAB are Baltimore Gas and Electric Company (BGE), Commonwealth Edison (ComEd), Dominion Energy, Orange and Rockland Utilities (O&R).
  - IEEE is talking to several other utilities who have interest.

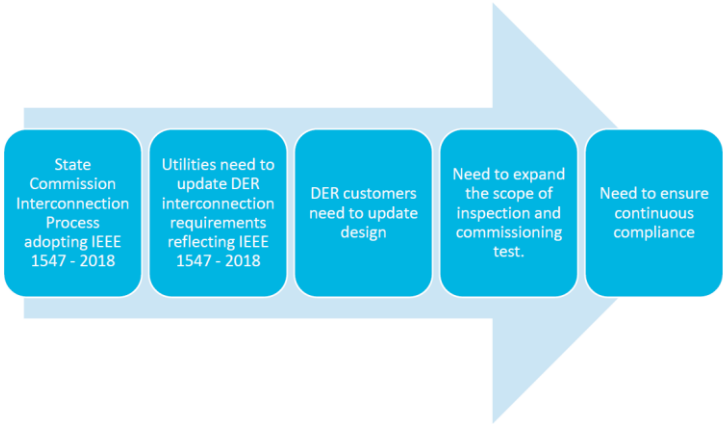
Further details of this program can be found at the link below:

https://standards.ieee.org/products-services/icap/programs/der/index.html

- **Summary**

  Ensure that a qualified workforce is available to support the growth of the renewable energy industry as IEEE Std 1547-2018 is adopted globally. IEEE proposes a program that will evaluate and certify individuals who can verify installed DER Interconnections (residential, utility-scale, Micro-grid, etc.) for their compliance to IEEE Std 1547 and local jurisdictional requirements.

FULL ADOPTION OF 1547-2018 – MULTI-STAKEHOLDER VIEW



GENERAL TIMELINE

BACKGROUND

The IEEE 1547 Conformity Assessment Steering Committee was established in 2016

Published 2 Documents related to Commissioning of 1547 compliant DER Interconnections

- Assessment of DER Interconnection Installation for Conformance with IEEE Std 1547
- Conformity Assessment--IEEE 1547--Interconnection and Interoperability of Distributed Energy Resources (DERs) with Associated Electric Power Systems (EPSs) Interfaces

Completed 6 Pilot Commissioning activities based on ICAP 1547 Conformity Assessment Document

- Pilot activities provided use case examples of using the ICAP 1547 CA Document for the assessment of DER Interconnections to the IEEE 1547-2003/2014 standard.
- Pilots included a thorough review of the DER Interconnection's documentation, settings, physical installation and intended modes of operation.
- The most recent pilot took place in Winneba, Ghana in the Fall of 2019 at a 20 MW Solar Installation.

PROGRAM BENEFITS TO STAKEHOLDERS

- **Increase industry pool** of qualified individuals who can verify installed DER Interconnections for their compliance with the IEEE 1547-2018 standard.
- **Provide a competitive resource** for the assessment of all DER Interconnections INCLUDING Residential.
- **Provide competent resources** for owners/developers needing direction for proper commissioning according to IEEE 1547-2018.
- **Alleviate burden on the utility's** of high penetration of DER interconnections and wide range of varying DER technologies.
- **Standardize commissioning process** with applicable documentation for the assessment of installed DER interconnections to IEEE 1547/1547.1.
- **Address Periodic Testing/Inspection Gap** of DER for continued proper operation of DER and its capabilities.
- **Promote DER adoption** through the addition of knowledgeable 1547-2018 personnel and standardized commissioning resources.
- **1547 Compliance Resource** for regulators and other AHJs mandating IEEE 1547 compliance.

IEEE Certified™

ADDRESSING DUKE ENERGY'S NEEDS

Interconnection Agreement	Commissioning	Post Commissioning
DER contractual obligation	DER Construction quality, safety code and standards	DER operational performance and financial requirements
DER Interconnection and Interoperability requirements defined in IEEE 1547-2018 and adopted by utility	Test and Verification requirements defined in IEEE 1547-2018 and IEEE 1547.1-2020	DER continued IEEE 1547-2018 compliance

IEEE 1547 CERTIFIED COMMISSIONING AGENT PROGRAM

IEEE Certified™

- Streamline and Standardize the 1547 compliance assessment for Residential PV and small-scale PV Projects. No such process at Duke currently.
- Supplement and enhance the existing utility-scale DER commissioning process at Duke.

Agenda

- Self-inspection Process Update
- Expected Timeline
- IEEE Std 1547-2018 Education and Credentialing Program
- Q&A, open discussion

Attachment E

Solar Operational Report

Duke Energy Carolinas

Date Last Refreshed
8/30/2020 10:50:57 PM

Customer Account Name	Installer Account Name	Zone	DIS FID	BKR_Value
123 Solar, LLC	123 Solar	Northern	12345678	OPEN

OPEN

1

CLOSED

121

Generation Offline (MW)

3.00

Attachment F

Applies to DERs with a 351/651 Recloser at the POI.

Goals

- Proactively address outages at distribution solar interconnections.
- Currently a weekly report, with the intent to be a daily report.
- Raise awareness to Duke leadership across all distribution zones to facilitate restoration ASAP.
- Track outage causes (IE: frequent equipment failure, load encroachment, etc.).

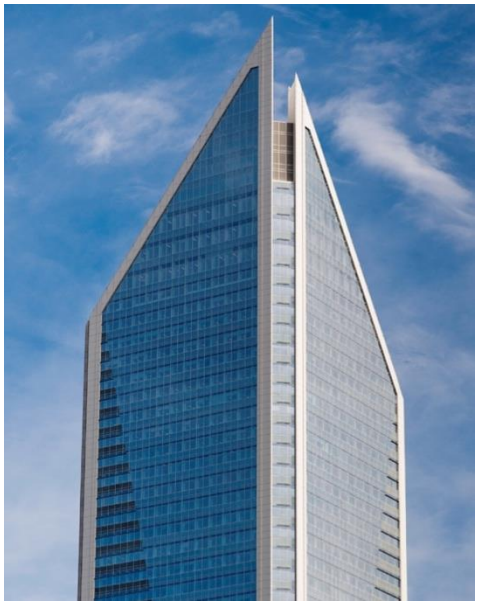
We need your help identifying an issue at your site. If recloser locks out Duke Energy will roll a truck to inspect our equipment. A call is placed to developer to look at their equipment, before site generation can be restored.

Distributed Generation (DG) Guidance Map

Attachment G

9/2/2020








ISOP Integrated System & Operations Planning

DUKE ENERGY®

Overview

- Objective & Value
- Map Release & Refresh Plan
- Data Elements
- Depiction of cumulative DG Constraint
  - Cumulative Constraint Calculation example
- Depiction of individual DG Site Limit
- Feedback on locational identifiers
  - Interstates & counties vs Lat/long grid
- Other feedback or questions

Objective & Value

Objective:

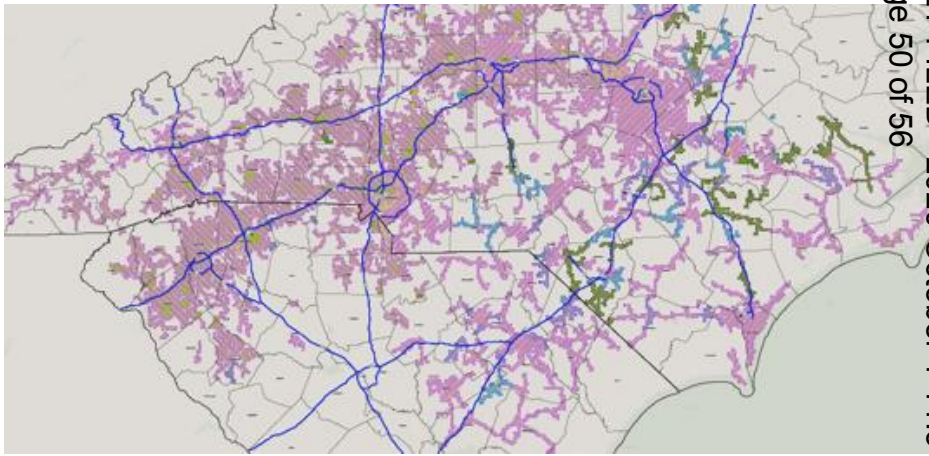
- Provide a geographical visualization of the distribution system in a manner consistent with the "Method of Service Guidelines" to inform siting of future distributed generation.

Value:

- Greater visibility of system constraints
- More efficient identification of potential sites
- Improve interconnection success rate

Map Release & Refresh Plan

- Capture questions and feedback from TSRG today, rollout timing dependent on feedback.
- Complete internal QA review of map.
- Post as a self-contained PDF file on the *Generate Your Own Renewables >20kW* website including disclaimer of map limitations.
- Email TSRG distribution list once PDF is posted.
- Planning to refresh map annually.



Map example with dummy colors

Data Elements

Inputs:

- Installed and queued distributed generators (DG) >=250kW nameplate capacity
- Substation bank transformer ratings (ONAN)
- Circuit planning ratings
- Circuit topology above the LVR (line voltage regulator)
- Circuit voltage class

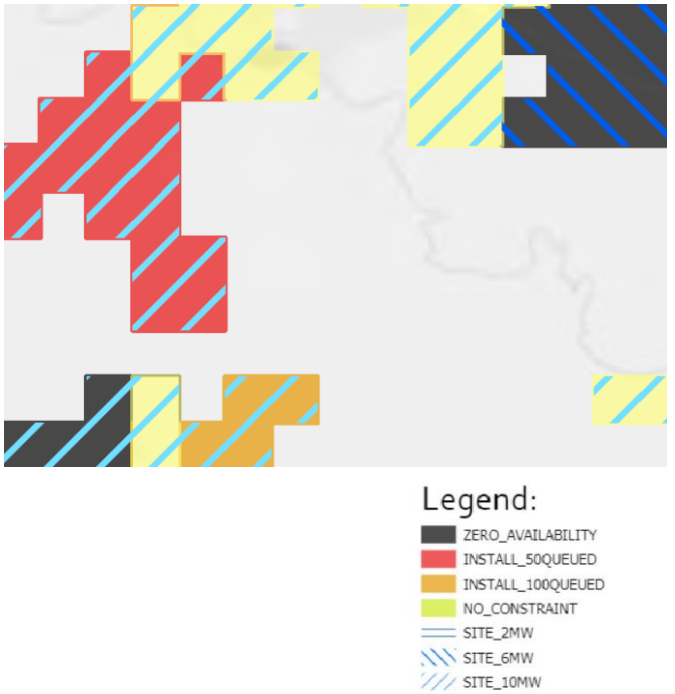
Outputs:

- Color shading to indicate cumulative DG constraint for each circuit reflecting both installed and queued DER capacity
- Cross-hatching to indicate voltage class which corresponds to individual DG site size limit

Cumulative DG Constraint

- Color shading – in order of decreasing constraint
  - Black = installed DG > circuit/bank limit
  - Red = installed DG + 50% queued DG > limit
  - Orange = installed DG + 100% queued DG > limit
  - Yellow = installed DG + 100% queued DG < limit

- Methodology
  - DG capacity compared against both substation transformer bank limits (ONAN rating) and circuit limits (planning rating)
  - Topology shown above the LVR and pixelated to 1 sq mi to maintain security of grid data
  - When conflicting colors exist within same sq mile, map shows the less constraining color (e.g. yellow instead of black)



Cumulative Constraint Calculation example

Illustrative mockup of three circuits on a bank that is not constrained:

Circuit #	Feeder limit (kVA)	Installed DG (kW)	Queued DG (kW)	Bank	Bank limit (kVA)	Total installed DG for Bank (kW)	Total queued DG for Bank (kW)	Color on Map
1	20,000	10,000	1,000	1	33,600	20,000	6,000	Yellow
2	10,000	0	5,000	1	33,600	20,000	6,000	Yellow
3	10,000	10,000	0	1	33,600	20,000	6,000	Black

Illustrative mockup of three circuits when bank is constrained (at 100% of DG queue):

Circuit #	Feeder limit (kVA)	Installed DG (kW)	Queued DG (kW)	Bank #	Bank limit (kVA)	Total installed DG for Bank (kW)	Total queued DG for Bank (kW)	Color on Map
4	20,000	10,000	1,000	2	33,600	25,000	11,000	Orange
5	10,000	5,000	10,000	2	33,600	25,000	11,000	Red
6	10,000	10,000	0	2	33,600	25,000	11,000	Black

**bank limit overrides circuit limit for circuit # 4 since bank is more constraining*

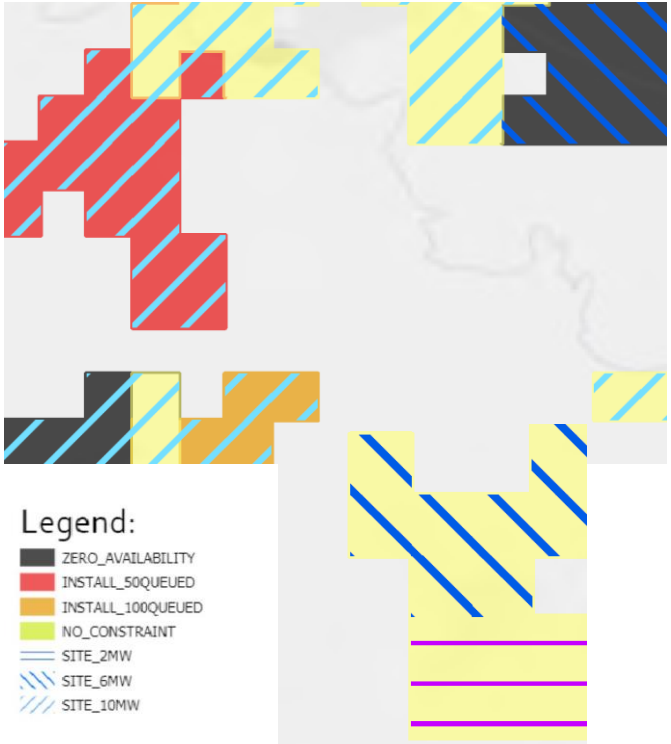
Legend:

- ZERO_AVAILABILITY
- INSTALL_50QUEUED
- INSTALL_100QUEUED
- NO_CONSTRAINT
- SITE_2MW
- SITE_6MW
- SITE_10MW

Individual DG site size limit

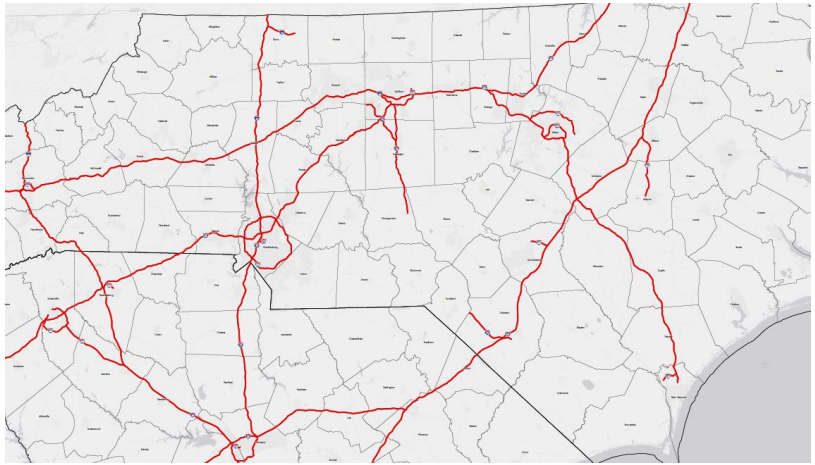
- 4 types of cross-hatching
  - 25kV and 35 kV class – 10MW limit
  - 15 kV class – 6MW limit
  - Served by 44 kV – 3MW limit
  - 5 kV class – 2 MW limit

- Methodology
  - When conflicting voltage classes within same sq mile, show the least constraining class from the set of circuits within the depicted cumulative constraint color.



Interstates & counties vs Lat/long grid

Interstates & counties



Lat/long grid